ATT-72/94, SALT SIEVE ANALYSIS

1.0 SCOPE

This method describes the procedure for determining the gradation of salt.

2.0 EQUIPMENT

sieves: 80 µm, 160 µm, 315 µm, 630 µm, 1 250 µm, 2 500 µm, 5 000 µm, and 10 000 µm.

electronic balance - capable of reading to 0.1 g; operated and calibrated as per manufacturer's recommendations.

sieve pan and lid	spatula	paint brush
putty knife	drying pans	sieve brush
sample divider	pie plates	2 R plastic container

Data Sheets: 20 000 µm Sieve Analysis, MAT 6-25 and
Salt Gradation Report, MAT 6 - 96

3.0 PROCEDURE

3.1 Sample Preparation

1. Obtain a sample of representative salt as directed in ATT-71, SAMPLING SALT.

2. Reduce the salt sample to the minimum required testing size of 200 g as directed in ATT-57, using the sample divider to split the original sample into the large mixing pans, discarding half each time.

3. Label and tare a pan. Record the pan number and tare weight in line "D" as shown in Figure 1.

4. Place the sample in the tared pan and weigh it. Record as Wt. of Wet Sample + Pan (line "A"). Use this sample for the dry sieve analysis.

5. Dry the moisture content sample to a constant weight in the oven as directed in ATT-15, Part I, MOISTURE CONTENT, Oven Method. Record as Wt. of Dry Sample + Pan (line "B").

6. Use the Wt. of Dry Sample (line"E") as the Wt. of Dry Sample for the sieve analysis.

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MINUS 20 000 µm SIEVE ANALYSIS

DATE	CONTRACT NO.	PROJECT NO.
CONTRACTOR		DISTRICT
PIT NAME		SAMPLE NO.
PIT LOCATION		SAMPLE SOURCE
STOCKPILE LOCATION		HOURS WORKED h
DESIGNATION / CLASS		OUTPUT t

MOISTURE CONTENT

A	WT. OF WET SAMPLE + PAN		g	
B	WT. OF DRY SAMPLE + PAN		g	
C	WT. OF WATER	A - B	g	
D	WT. OF PAN (NO. _____)		g	
E	WT. OF DRY SAMPLE	B - D	g	
F	MOISTURE CONTENT	100 C / E	%	

TYPE OF WORK

- ACP ☐
- RACP ☐
- GBC ☐
- CSBC ☐
- ASBC ☐
- SEAL COAT ☐
- OTHER ☐

SAMPLE APPEARANCE

- SOFT ROCK ☐
- PEA GRAVEL ☐
- CLAY LUMPS ☐
- IRON NODULES ☐
- ENCRUSTED ☐
- COAL ☐
- OTHER ☐

SIEVE ANALYSIS

G	WT. OF WET SAMPLE + PAN		g	
H	WT. OF PAN (NO. _____)		g	
I	WT. OF WET SAMPLE	G - H	g	
J	WT. OF DRY SAMPLE	100 I / (100 + F)	g	

MATERIAL TYPE

- COARSE ☐
- NATURAL FINES ☐
- MANUFACTURED FINES ☐
- BLEND SAND ☐

EST. DRY STRENGTH OF FINES

- NON - PLASTIC : TRACE ☐
- LOW ☐
- MEDIUM ☐
- HIGH ☐

WASHED SIEVE

SIEVE SIZE (µm)	K WEIGHT RETAINED (g)	L WEIGHT PASSING (g)	M % PASSING 100 L / J	N CONTRACT SPECIFICATION
20 000				
16 000				
12 500				
10 000				
5 000				
1 250				
630				
315				
160				
80				
SIEVE PAN		DRY WASH WT. + PAN = _____ g		
TOTAL WEIGHT		$DIFFERENCE = \left(\frac{DIFFERENCE}{DRY\ WASHED\ WT.}\right) \times 100$		
DRY WASH WT.				
DIFFERENCE				
% DIFFERENCE		MAXIMUM % DIFFERENCE IS 0.5 %		

CALCULATIONS

HAS AN IDENTICAL SAMPLE BEEN FORWARDED TO A TESTING LABORATORY ? _____ DATE _____

REMARKS _____

_____

MATERIALS TECHNOLOGIST _____ PROJECT MANAGER _____

Figure 1

3.2 Sieve Analysis

1. Stack the sieves together in order of sizes and attach the pan to the 80 Fm sieve.

2. Pour the salt into the top sieve, place the lid on the topsize sieve and shake the stacked sieves and salt for about 30 seconds to initially separate the sizes.

   If using a mechanical sieve shaker, refer to Section 4.0.

3. Remove the sieve pan, place its material into a clean pie plate and set the pie plate aside.

4. Place the stacked sieves on a clean pie plate.

5. Remove the top size sieve containing the retained salt and nestle it into the sieve pan carefully, so that no material is lost. Sieve this material using a lateral and vertical motion of the sieve, accompanied by jarring action so as to keep the sample moving continuously over the surface of the sieve.

6. After a minute of sieving, remove the sieve from the sieve pan, taking care not to lose any material.

7. Place the salt trapped in the sieve pan, into the next lower size sieve at the top of the stacked sieves.

8. Set the sieve pan back under each sieve and continue sieving until 1 g or less passes when sieved for one minute.

9. Set a drying pan or pie plate on the scale and tare it. Record the weight on the "Calculations" portion of the data sheet. Use this pie plate or pan to weigh the "weight retained" on all sieves, so that the tare weight is constant throughout the test.

10. Place the salt retained on the topsize sieve into the tared pie plate. Thoroughly clean the sieve onto the pie plate.

11. Weigh the salt and the tared plate or pan and record the weight in the calculations portion. Calculate the Weight Retained and enter it on the line corresponding to the 10 000 µm, or 5 000 µm sieve, depending on the topsize of the salt being used.

12. Place the oversize salt in a separate pie plate and save it until the test is complete, in case a weighing error is found when performing the calculations.

13. Place the material passing the 80 µm sieve in the tared pan and add the material in the pie plate saved from step 3 (also -80 µm material), weigh it and record it in the "Calculations" portion of the data sheet.

14. Calculate the weight of the -80 µm material retained in the sieve pan. Record it in the Wt. Retained column on the "Sieve Pan" line.

15. Add all the figures in the Weight Retained column, including the weight of material in the sieve pan.

3.3 Salt Sample Dry Weight

1. Calculate the weight of water removed while drying the moisture sample (line "C" of MAT 6-25) as follows:

   = ***(Wt. of Wet Sample + Pan) - (Wt. of Dry Sample + Pan)***

2. Determine the dry weight of the moisture sample (line "E") using the formula:

   = ***(Wt. of Dry Sample + Pan) - (Wt. of Pan)***

3. Calculate the moisture content in percent of the salt (line "F") as follows:

$$\text{Moisture Content (\%)} = \frac{\text{Wt. of Water}}{\text{Wt. of Dry Sample}} \times 100\%$$

4. Calculate the % Difference using the formula:

$$\left| \frac{\text{Wt. of Dry Sample (line "E") \& Total Wt. Retained}}{\text{Wt. of Dry Sample}} \times 100\% \right|$$

   If the difference is larger than 0.5%:

   a) Check the calculations.

   b) Check the scale and re-zero it, if necessary.

   c) Re-weigh all tares as well as the material retained in each sieve and kept in the untared pie plates.

   d) If the error is not found, perform a dry sieve analysis test on the moisture content sample as directed in Section 3.2.

3.4 Percent Passing

1. Determine the weight passing the topsize sieve as follows:

   = ***Wt. of Dry Sample - Wt. Retained on the topsize sieve***

2. Determine the weight passing the other sieves as follows:

   = ***Wt. Passing the previous sieve - Wt. Retained on sieve***

3. Calculate the % passing each sieve as follows:

$$\text{Percent Passing (\%)} = \frac{\text{Wt. Passing}}{\text{Wt. of Dry Sample}} \times 100\%$$

4. Enter in the next column the contract specifications limits for the designation and class of salt being tested and compare them to the sieve analysis results.

5. Report the sieve analysis results on the Salt Gradation Report as shown in Figure 2.

ALBERTA TRANSPORTATION AND UTILITIES

SALT QUALITY ASSURANCE REPORT

CENTRAL CANADA POTASH

Report Date 95.03.10
Report To A.D.T.E. (DIST - 1,2,4,13,14)
cc T. Hart (TOB)
M. Henry (CCP)

Form No. 1550-2

District No.	Salt Type	Maintenance Yard	Date Sample Rec'd	Lab. No.	Bill of Lading #'s	QA Sieve Results 10000	5000	2500	1250	630	315	160	80
1	Blend	Brooks	941117	501553	n/a		89	60	48	16	2	1.0	0.0
			941122	501665	1872		84	68	57	30	9	1.9	0.6
					1873								
			950117	502378	0836		82	61	48	12	0.8	0.3	0.2
					0837								
			950202	502609	0838		91	77	51	10	1.5	0.3	0.1
2	Fine	Cardston											
2	Fine	Coleman	950130	502534	0627		100	100	95	23*	4	0.4	0.0
				502619	1561		100	100	99	65	25	2.6	0.2
2	Fine	Ft. Macleod	941123	501685	1705		100	100	99	57	20	1.9	0.1
					1711								
			950130	502536	0911		100	100	97	25*	0.8	0.2	0.0
				502709	0626		100	100	98	45	11	0.9	0.0
					0578								
			950222	502817	3255		100	100	97	25*	0.8	0.2	0.1
2	Fine	Lethbridge	941121	501687	1951		100	100	98	23*	2	0.4	0.2
					1952								
			941130	501784	0010		100	100	99	50	10	0.9	0.0
			941201	501792	0143		100	100	98	53	18	2.3	0.0
					0144								
	(A.T.&U. Sample)		950103	502129	0394		100	100	95	8*	0	0.0	0.0
			950130	502537	0690		100	100	99	35	1.9	0.2	0.1
					0691								
					0925								
					0926								
			950222	502815	0929		100	100	100	47	7	0.4	0.2
2	Fine	Magrath	941130	501785	0027		100	100	100	56	3	0.2	0.0
					0026								
			950130	502531	0901		100	100	98	37	2	0.2	0.1
			950222	502816	0902		100	100	98	39	6	0.4	0.2
2	Fine	Pincher Creek	950103	502127	0289	(A.T.&U.)	100	100	98	35	6	0.5	0.1
			950222	502819	3311		100	100	98	27*	1	0.6	0.4
				502993	3312		100	100	98	39	7	0.5	0.0
2	Fine	Vulcan	941130	501788	1986		100	100	98	35	5	0.5	0.2
			950130	502535	0628		100	100	98	38	3	0.3	0.1
					0629								
					0835								
2	Fine	Taber	941123	501686	1831		100	100	99	64	14	0.7	0.0
			941130	501787	0025		100	100	99	59	9	0.4	0.2
			941202	501793	0114		100	100	97	43	11	2.0	0.0
	(A.T.&U. Sample)		950103	502126	0279		100	100	93	18*	5	0.7	0.0
			950130	502532	0833		100	100	98	45	10	1.1	0.2
2	Fine	Warner	941130	501786	1987		100	100	100	62	9	0.7	0.2
					0041								
			950130	502533	n/a		100	100	98	43	13	2.5	0.5
			950222	502818	0899		100	100	98	47	10	0.8	0.3
					0900								
2	Fine	Willow Creek	941202	501791	0042		100	100	98	32*	2	0.0	0.0
					0043								
	(A.T&U. Sample)		950103	502128	0238		100	100	98	45	7	0.9	0.1
Fine Salt Spec. (* - Denotes out of spec.)							100	98-100	85-100	35-100	0-50	0-8	0-3
Coarse Salt Spec. (* - Denotes out of spec.)						100	55-90	5-60	0-25	0-8			

Figure 2

4.0 MECHANICAL SIEVE SHAKER

Mechanical sieve shakers may be used after their effectiveness is established for each salt source and topsize.

The minimum shaking time for a mechanical sieve shaker is determined in Section 4.1 below. The effectiveness of the mechanical sieve shaker must be compared to the hand-sieving method as directed in Section 4.2.

4.1 Sieve Shaker Required Shaking Time

1. Obtain a representative sample of salt as described in ATT-71, SAMPLING SALT.

2. Process the sample as directed in Sections 3.1 and 3.2. The salt sample must be at least 200 g. The sample size used for this evaluation is used as a standard.

   All subsequent samples processed with the mechanical sieve shaker shall be within 20% of this weight and must be at least 200 g. A new evaluation must be performed if this criteria is not consistently met. However, a new evaluation is not necessary if hand-sieving is used to check the mechanical shaker.

3. Place the loaded stacked sieves, with the sieve pan and top in place, in the shaker.

4. Turn on the mechanical shaker for at least 5 minutes.

5. Weigh each sieve and the salt retained on the sieve.

6. Reassemble the sieves, place the sieves in the mechanical shaker, and shake for at least one more minute.

7. Weigh each sieve and the material retained on the sieve.

8. For each sieve again calculate the weight passing and the % Passing as described in Section 3.4.

9. Repeat Steps 5 to 8 until the difference in % Passing is less than 0.5% for the topsize to 315 sieves and 0.05% for the 160 and 80 sieves.

10. The **minimum** required shaking time for the mechanical shaker for all subsequent sieves shall be 125% of the total shaking time required to achieve the above criteria. This is determined by multiplying the total time by 1.25.

4.2 Verification of Mechanical Shaker to Hand Sieving

1. Obtain another representative sample of salt as described in ATT-71, Sampling Salt.

2. Process the sample as described in Sections 3.1, 3.2, 3.3 and 3.4.

3. Recombine the processed sample, weigh and record as total sample weight.

4. Re-sieve the sample using the mechanical sieve shaker for the required shaking time established in step 10 of Section 4.1, above.

5. Calculate the % Passing as described in Section 3.4.

6. The mechanical sieve shaker is comparable to hand sieving when:

   a. The % Passing the topsize to 315 sieves are within ± 0.4% of hand sieving and

   b. The % Passing the 160 and 80 sieves are within ± 0.04% of hand sieving.

5.0 HINTS AND PRECAUTIONS

1. Clean the sieves after each sieve analysis test. Use the round sieve brush to clean the 630µm, 315 µm, 160µm and 80µm sieves by brushing lightly on the bottom side of the mesh. Use the putty knife on the larger sieves.

2. Always nestle the 80 µm sieve in the sieve pan and cover it with the lid when the sieve is not in use.

3. The 80µm and 160 µm sieves have very fine mesh which could easily be punctured. Therefore, do not place material on the 80µm or 160µm sieves that has not passed through the 315 µm sieve first.

4. Follow the directions in the care and handling of sieves.

5. The mechanical sieve shaker may cause degradation. This can be noted by an increase in % Passing above the limits described in the verification procedure, Section 4.2.

6. Whenever there is a discrepancy between mechanical and hand sieving, the hand sieve results shall rule.